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**D-70449 Stuttgart (DE)**(54) **Device for stacking flat articles to form one or more stacks into a box-shaped container.**

(57) There is disclosed a stacking device which allows to stack flat articles to form one or more stacks into a box-shaped container.

The device is located at the output of a conveyor system or the like; the advancing article therefrom is translated through inclined chutes (3) on a supporting plane (1) in its stacking position. By taking away the supporting plane with a rapid movement the article maintains by inertia its position and its orientation and is dropped into the underlying container (2) on the prefixed stack.

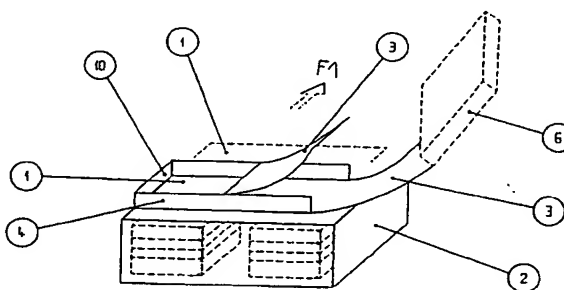


FIG. 1

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The present invention relates to a device for stacking flat articles to form one or more stacks into a box-shaped container.

At the present time there are known several kinds of stackers designed to stack various flat articles, such as books, cassettes, records and the like, coming from a standard transport system or a sorting machine, into box-shaped containers.

These stackers can be used in a lot of fields: e.g. they can be used for forming packages in the field of publishing business or in the field of food-stuffs packaging, in the field of postal services and the like.

One of these known kinds of stackers is the one disclosed e.g. in US 3,937,456 (Gruodis et al.) It comprises a movable article transporter, inclined slides located beneath the transporter, and containers having three sides and an open top, located at the lower end of the slides.

The containers are mounted on respective sensor controlled elevators for adjusting the height of containers in accordance with the height of the stack detected by the sensors.

When a container is full, it is replaced with an empty one.

The containers have an inclined interior floor surface and are of a very complicated structure. Moreover, when one or more stacks of articles are to be formed within a package it is necessary to remove manually the finished stacks from the containers and place them in the package which represents an additional cost. Further, the stacker as a whole is somewhat complicated and expensive.

In U.S. 3,888,363 there is disclosed an indexing stacker for flat objects. It is composed of four compartments and the articles are delivered to each compartment by conveying means. When a stack of predetermined number of articles is formed in the compartment the stacker is indexed 90 degrees and an empty compartment faces the output of the conveyor in order to be filled. When all the four compartments are filled with the required number of articles, the finished stacks are removed, either manually or through automated means, and placed in a box.

Also this type of stacker involves an additional operation and therefore an additional cost. Moreover, this device is somewhat complicated and expensive, too.

Other stacking devices are based upon modules having the bottom surface which is opened like a hinged trapdoor over the container allowing the carried article to be dropped into the container. However also these devices, besides requiring complicated mechanism for opening and closing the bottom whereby they are subjected to jamming, they require a certain spacing between the container and the trapdoor in order to permit the

downwards opening of the latter and because of the long trajectory of the falling articles, the resulting stacking is not well tidy.

The task of the present invention is to overcome the drawbacks of the prior art stacking devices by providing a device for stacking flat objects to form one or more stacks into a box-shaped container which, besides allowing a tidy stacking, is at the same time simple and inexpensive.

Within said task, it is an object of the present invention to provide a flat article stacking device of the type mentioned at the outset which is passive in nature and requires a lower number of moving parts with respect to prior art similar devices.

It is a further object of the invention to provide a flat article stacking device that still reduce the impact velocity of the article which is to be stacked with respect to prior art similar devices.

These and other objects which will become apparent hereinafter are achieved by a flat article stacking device according to the present invention having the characteristics set forth in the characterizing portion of claim 1.

Advantageous aspects of the invention are set forth in the subclaims.

The basic idea is to lay down the articles, which are to be stacked into a container, on a supporting plane subdivided into as many parts as the underlying stacks to be formed in the container are, and to take away the support so fastly as to leave the articles in their rest position from which they drop by gravity into the underlying container thus maintaining their orientation.

Thanks to this solution a simple and inexpensive flat article stacking device since it does not use complicated mechanisms for opening and closing hinged bottom walls and/or to rotate the container.

Further characteristics and advantages of the invention will be more apparent from the following description of an embodiment thereof made with reference to the drawings attached as an indicative and not limiting example wherein:

- Fig. 1 is a schematic representation in a perspective view of the stacking device according to the present invention;
- Fig. 2 is a front elevation schematic view of the device of fig.1;
- Fig. 3 shows another advantageous embodiment of the stacking device according to the present invention in a top plan view; and
- Figs. 4 and 5 show a detail of the devices illustrated in figs 2 and 3 respectively.

Referring now to figs 1 and 2, the stacker according to the invention is composed of a low-friction plate-shaped member 1 providing the supporting plane and disposed above the top opening of a box-shaped container 2 inside which flat articles 6

are to be stacked and which is supported on a base 7. The plate-shaped member 1 is provided with wheels 9 rolling on horizontal guides 8 and it is horizontally movable (in the direction indicated by arrow F1) from a rest position where it practically covers the opening of container 2 to a discharge position (indicated by dashed line in fig 2) where said opening is left uncovered by member 1 and viceversa.

Member 1 is moved by actuator cylinder 5 having an end connected thereto and the other end is fixedly connected to the support structure (not shown) of the stacker itself.

Arranged above the plate-shaped member 1 is a supporting frame 4 fixed to the supporting structure and having a substantially rectangular shape (see fig.1) on which there are one or more inclined chutes 3 (one for each stack to be formed) whose lower end is on the plate-shaped member 1, said lower end being parallel to the direction of motion indicated by arrow F1.

The stacking device according to the invention operates as follows.

The plate-shaped member 1 forms a supporting plane for the articles 6 which are delivered by the conveyor or sorting apparatus selectively to each chute 3 upon command of the electronic control system of the conveying or sorting system (not shown) which the stacker is associated with.

Articles slide on chutes and stop on the supporting plane with the prefixed orientation in a position corresponding to the underlying stack in the container 2. The rim 10 and each of subsequent chutes constitute a stop ledge for correctly positioning the articles on the supporting surface.

Upon command of conventional means connected with said electronic control system, the actuator cylinder 5 moves very quickly the plate-shaped member 1 to the discharge position. Because of this very rapid motion, the articles maintain their rest position by inertia and, being no longer supported on the supporting plane are dropped into the underlying container thus maintaining their orientation.

The plate-shaped member is then restored in its rest position before next article is delivered by the conveyor or sorter.

To advantage, in order to improve the attitude of the articles during the fall, the supporting plane is slightly inclined at an angle  $\alpha$  (see fig 4) downwards in the direction of its displacement to the discharge position.

In a further, advantageous, embodiment of the stacker according to the present invention, illustrated in figs 3 and 5, the supporting plane is formed by two adjacent plate-shaped members 1a, 1b, joining along one side when in the rest position, which side is perpendicular to the direction of dis-

placement. The two members 1a, 1b, are movable in opposite directions with respect to said joining side by respective actuator means, like that (5) shown in fig 2, connected therewith.

Such arrangement has the advantage of requiring a velocity of translation reduced to one half with respect to the one required by the arrangement of fig 2.

Also in this case in order to improve the attitude of the falling articles, the two members 1a, 1b, are slightly inclined as shown in fig 5.

Thus the stacking device according to the present invention fully achieves all the above-mentioned objects.

In fact it is very simple in construction, inexpensive to manufacture and with very few moving parts as compared with similar devices in the prior art.

Moreover, the height of fall, and therefore the terminal speed of the articles, is reduced, whereby the risk of damages to delicate articles is decreased. The attitude of the articles is maintained thus obtaining a tidy stacking within the container.

A further advantage is that with the stacker according to the invention it is possible to stack at the same time a plurality of articles to form a corresponding plurality of stacks in the container thus reducing the stacking time.

Naturally numerous modifications and structural changes may be made without departing in any way from the spirit of the scope of the invention.

For instance, in order to further reduce the fall height of the articles, the underlying wheels 9 can be replaced with idle rollers pivoted directly at the sides of the plate-shaped element while suitably adapting the guides, of course.

Further, the rapid motion of translation can be realized through any suitable equivalent means.

Finally, materials and dimensions can be adapted to the circumstances and requirements of use.

## Claims

1. Device for stacking flat articles, advancing from an outlet of a conveyor system or the like, to form one or more stacks into a box-shaped container, said stacking device being characterized by comprising:
  - a supporting plane for the articles arranged above the container and movable rapidly and horizontally from a rest position in which it covers the top opening or said container to a discharge position in which said opening is left uncovered and viceversa;
  - means for actuating rapidly said supporting plane;

- a supporting frame arranged over said supporting plane, and
  - at least one inclined chute fixed to said frame and having the lower end on said supporting plane and parallel to the direction of motion of the latter, said at least one chute being adapted to receive said articles advancing from said outlet and transfer them by gravity on said supporting plane with a predetermined orientation.
2. Stacking device according to claim 1, characterized in that said supporting plane is formed by a plate-shaped member sliding with rolling friction on two fixed guides arranged parallelly to said direction of motion.
3. Stacking device according to claim 2, characterized in that said plate-shaped member is inclined downwards in the sense of its motion towards the discharge position.
4. Stacking device according to claims 1 and 2 characterized in that said actuating means comprise at least one actuator cylinder having an end connected with said plate-shaped member.
5. Stacking device according to claim 1 characterized in that said supporting plane is formed by two adjacent plate-shaped members joining along one side when in said rest position which side being perpendicular to said direction of motion and said two plate-shaped members being movable in opposite directions with respect to said joining side.
6. Stacking device according to claims 1 and 5 characterized in that said two adjacent plate-shaped members are each inclined downwards in the sense of the respective motion towards said discharge position.
7. Stacking device according to claims 1 and 5 characterized in that said actuating means comprise at least one actuator cylinder acting on each of said plate-shaped elements.

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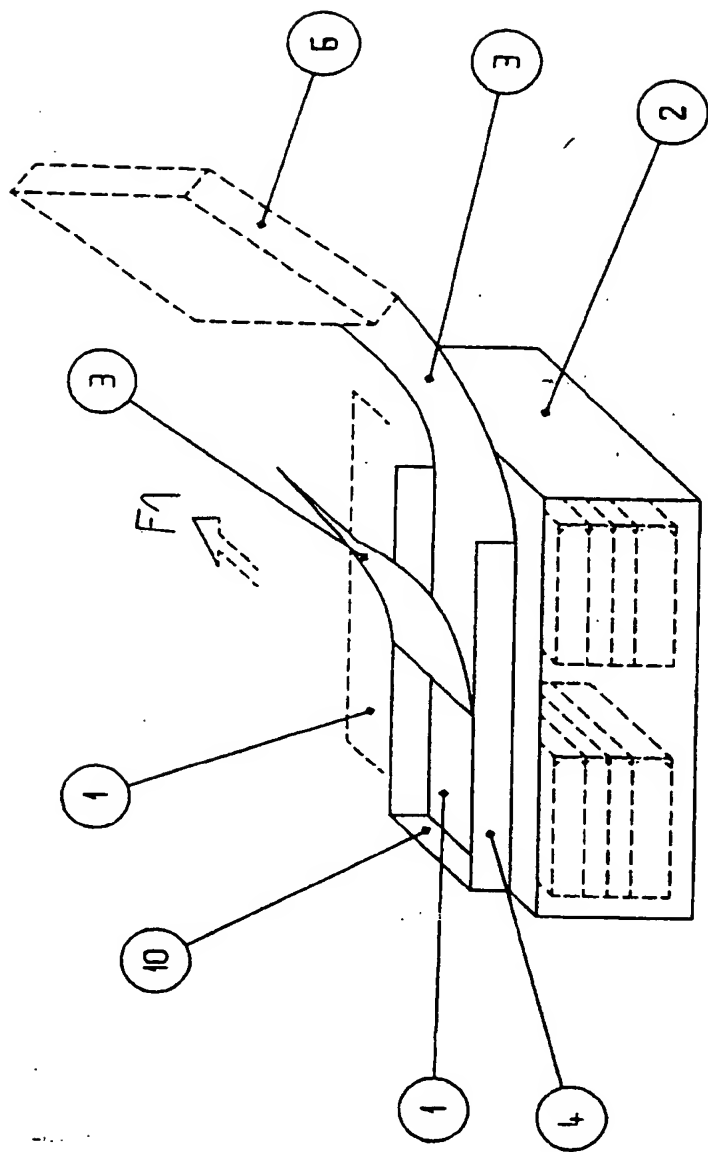
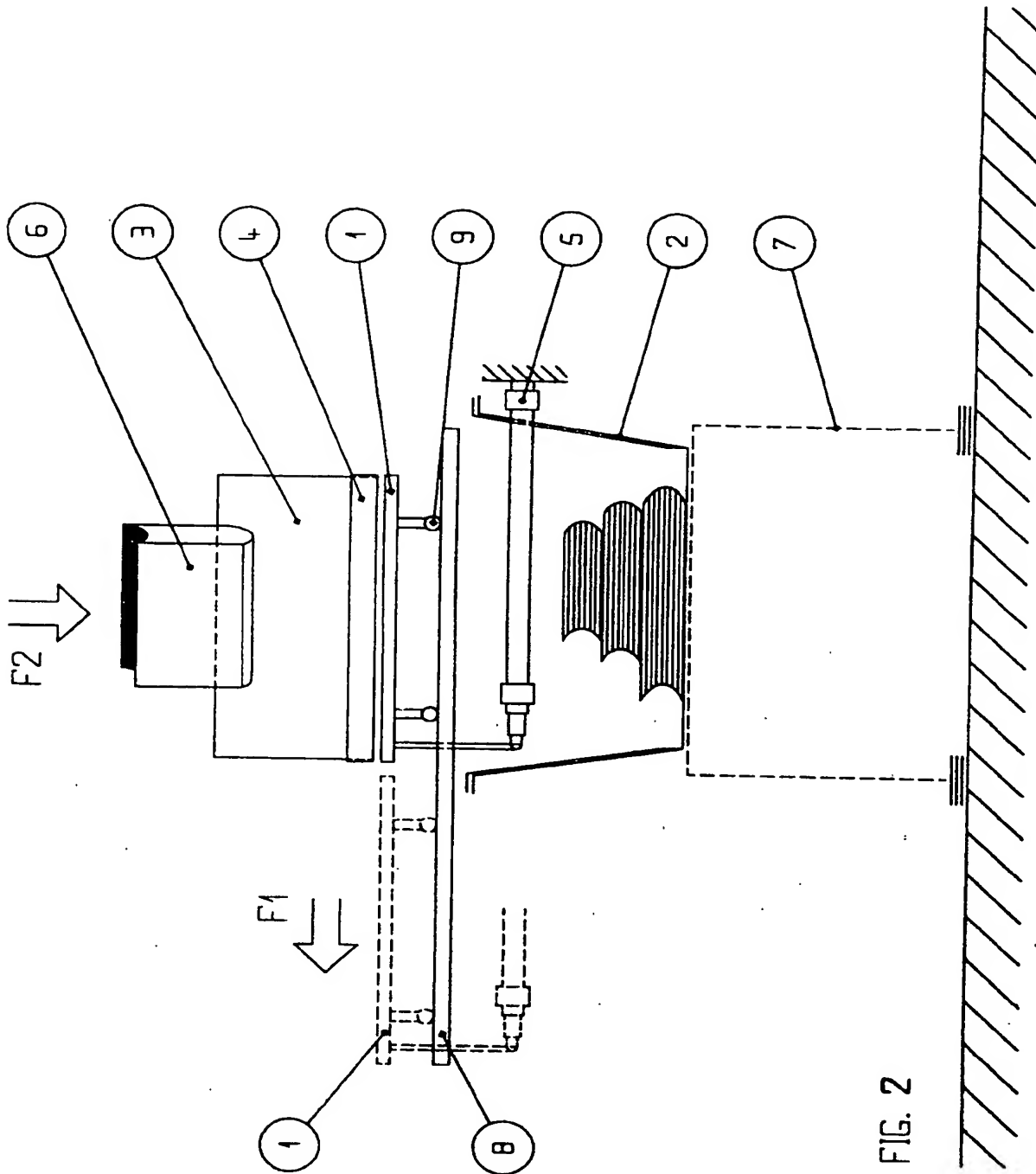
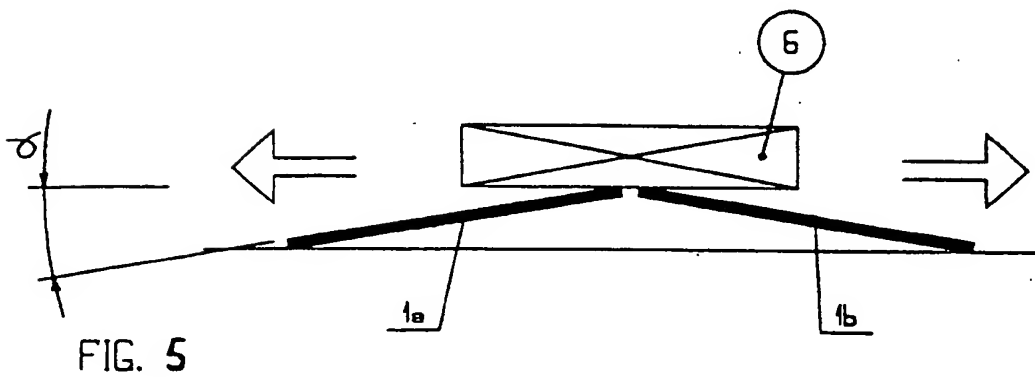
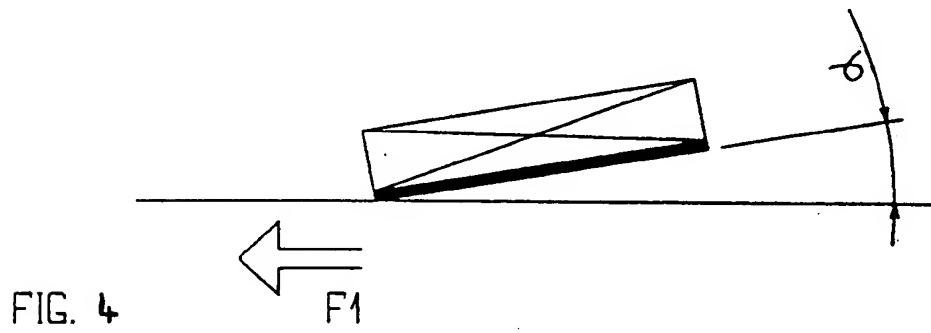
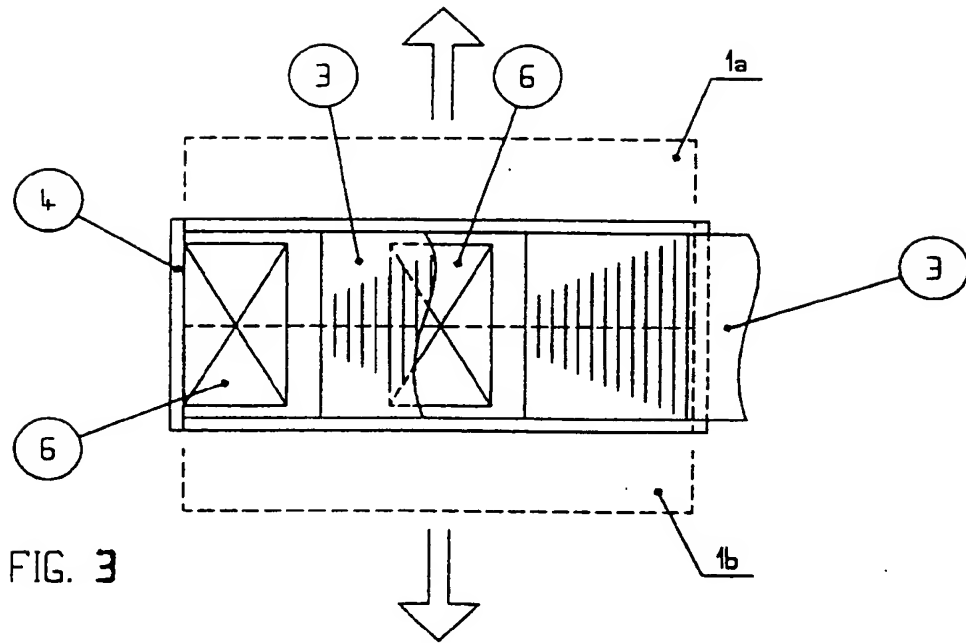


FIG. 1







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## EUROPEAN SEARCH REPORT

Application Number

EP 93 10 8068

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-A-1 924 949 (VEB)	1,5	B65B5/10
Y	* the whole document * ---	2,4,7	
Y	FR-A-2 388 721 (ROCHAT) * page 5, line 22 - line 26; figures 3,4 * ---	2,4,7	
A	DE-A-3 634 776 (RADKE) * abstract; figures 1A,1B * -----	3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B65B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 08 SEPTEMBER 1993	Examiner CLAEYS H.C.M.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	